

The HITEC logo features the brand name in a bold, italicized sans-serif font, preceded by a stylized graphic of three slanted parallel lines.

INSTRUCTION MANUAL

X1 MF

multi-function plus



AC/DC
FAST CHARGER

*Professional Balance Charger / Discharger
Lithium Battery Meter / Motor RPM Tester /
Servo Tester*

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Congratulations on your choice of the Hitec X1 MF digital intelligent charger from Hitec RCD USA.

This unit is simple to use, but the operation of a sophisticated automatic charger such as the Hitec X1 MF does require some knowledge on behalf of the operator. These operating instructions are designed to ensure that you quickly become familiar with its functions. It is important that you read the Operating Instructions and Warning and Safety Notes before you attempt to use your new automatic charger for the first time. The X1 MF is manufactured with the highest quality components for years of reliable operation, if used properly.

The Hitec X1 MF is a high-performance, microprocessor controlled charge/discharge station with battery management suitable for use with all current battery types. The X1 MF also features integrated balancing for six-cell, Lithium-Polymer (LiPo), Lithium-Iron Phosphate (LiFe/A123) and Lithium-Ion (LiIon) batteries.

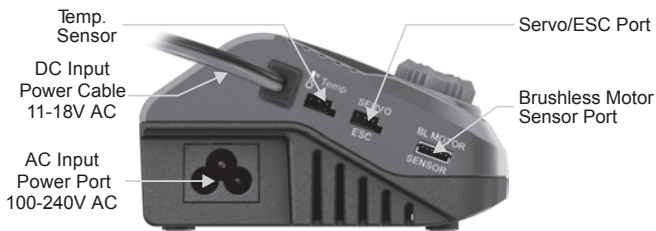
Maximum 10A charge current; maximum 80W charge power; can be powered by a 12VDC car battery or 100V-240VAC via the built-in switch-mode power supply.

When a Nickel battery is fully charged, the X1 MF terminates the process using the Delta-Peak method. Lithium and lead (Pb) batteries are charged using the Constant Current/Constant Voltage (CC-CV) method.

The system cooling fan operates via an internal temperature sensor, automatically adjusting its speed for maximum efficiency. The X1 MF also features a lithium Battery Meter, Motor RPM Tester and Servo Tester. The LCD display keeps users informed of all the pertinent information during all functions. Improper use of batteries or chargers is dangerous and can result in accident, injury, and fire. Please BE SURE to read these INSTRUCTIONS, WARNING and SAFETY NOTES before you use the charger for the first time.

INTRODUCTION

Please read this entire operating manual before using the X1 MF. If you are unsure of it's proper operation after reading the manual, please seek advice from an experienced hobbyist or someone familiar with proper battery charging procedures.



Optimized Operating Software

The Hitec X1 MF features an AUTO function that automatically adjusts the current during charging or discharging operations. Especially for lithium batteries, it can prevent overcharging which may lead to an explosion due to improper parameters set by the user. The X1 MF will disconnect the circuit automatically and produce an audible alarm upon detection of abnormal voltage or current loads. The X1 MF is designed to increase operator safety by monitoring the voltage and current activity throughout the charge or discharge processes.

Internal Independent Lithium Battery Balancer

The Hitec X1 MF employs an individual cell voltage balancer. It isn't necessary to connect a third party balancer for balance charging, simply use the included Universal Balancing Board when connecting Lithium packs.

Balancing of Individual Lithium Cells

The Hitec X1 MF can monitor and balance each cell individually while charging or discharging the battery. Error messages will be displayed on the LCD screen and the process will be terminated automatically if the voltage of any single cell is abnormal.

Accommodates Various Types of Lithium Batteries

The Hitec X1 MF is adaptable to various types of lithium batteries, such as LiPo, Lilon and the new LiFe series of batteries.

Fast and Storage Modes for Lithium Batteries

The X1 MF also features Fast and Storage modes for lithium charging. Fast mode reduces the overall charge time for quick turnaround at the field or track, keeping in mind that standard charging will result in a more complete charge at full capacity. Storage Mode allows for safe, longer term storage of lithium batteries. Storing LiPos at full charge can increase the probability of cell damage and pack "puffing."

Cyclic Charging/Discharging

Continuous charge>discharge or discharge>charge functions are available to refresh or restore NiCd and NiMH battery capacity and performance. These cycles can be set to automatically repeat from 1 to 5 times.

Data Store/Load

The charger can store up to 10 different charge/discharge profiles for your convenience. Each profile can store settings for battery type and charge/discharge parameters. You can easily recall these saved profiles to increase simplicity and efficiency of common processes.

Termination Voltage Control

The end charge voltage can be adjusted for each type of battery chemistry up to the maximum safe limit.

LiPo Battery Meter

Displays total battery voltage, each cell's voltage, and the highest and lowest cell voltages.

Motor RPM Tester (see page 28 for details)

ESCs equipped with motor RPM sensor ports can connect to the X1 MF to display real-time motor RPM.

Servo Tester (see page 29 for details)

The X1 MF can test most analog or digital servos by connecting them to the servo/esc port on the charger and adjusting the pulse width value.

Re-Peak Mode of NiMH/NiCd Battery

In re-peak charge mode, the charger can peak charge the battery once, twice or three times in a row automatically. This is good for making certain the battery is fully charged, and for checking how well the battery receives fast charges.

Delta-peak Sensitivity for NiMH/NiCd

Delta-peak charging for NiMH and NiCd batteries monitors the cells voltage and terminates the charge when the pack reaches full capacity. You can adjust the peak mV setting to either increase or decrease the charger's sensitivity to the voltage drop that occurs when the pack nears full capacity. **Note:** a lower mV setting is more sensitive and will terminate the charge process earlier than a higher mV setting.

Automatic Charging Current Limit

You can set the upper limit of the charging current when charging your NiMH or NiCd batteries. This is useful for NiMH batteries of low impedance and capacity when charging in the 'AUTO' charging mode.

Capacity Limit

The charging capacity is always calculated as the charging current multiplied by time. If the charging capacity exceeds the limit, the process will be terminated automatically when you set the maximum value.

Temperature Threshold *(requires optional temperature sensor, PN# 44159)*

NiCd and NiMH batteries become warm as the charge process completes. This is a normal condition and should be expected as the Delta Peak charge process completes the charging cycle. If the user inadvertently sets the mV sensitivity to an abnormally high value or if there is a problem with the battery (i.e, one or more bad cells in the pack) the battery temperature could exceed safe limits. If the external temperature limit option is enabled and the optional temperature sensor is installed and placed on the battery, the charge process will terminate if the user-set temperature limit is reached. Note: Lithium and Pb batteries should NEVER get warm during the charge process.

Processing Time Limit

Maximum charge and discharge process time limits can be set to protect against possible battery defects.

Hitec Charge Master Software

The free "Hitec Charge Master" software gives you unparalleled ability to operate the charger through the computer. You can monitor pack voltage, cell voltage and other data during charging and view charge data in real-time graphs. You can also initiate processes, control charging and update firmware from the "Hitec Charge Master" software.

WARNINGS AND SAFETY NOTES

These warnings and safety notes are particularly important. Please follow the instructions for maximum safety; otherwise the charger and the battery can be damaged or may cause a fire.

- ❗ The allowable DC input voltage is 11-18V DC.
- ❗ The allowable AC input voltage is 100-240V AC.
- ❗ Never leave the charger unattended when it is connected to its power supply. If any malfunction is found, **TERMINATE THE PROCESS AT ONCE** and refer to the operation manual.
- ❗ Keep the charger well away from dust, damp, rain, heat, direct sunshine and vibration. Never drop it.
- ❗ This charger and the battery should be put on a heat-resistant, non-flammable and non-conductive surface. Never place them on a car seat, carpet or similar surface. Keep all flammable volatile materials away from the operating area.
- ❗ Make sure you know the specifications of the battery to be charged or discharged to ensure it meets the requirements of this charger. If the program is set up incorrectly, the battery and charger may be damaged. Fire or explosion can occur due to overcharging. This warranty is not valid for any damage or subsequent damage arising as a result of a misuse or failure to observe the procedures outlined in this manual.
- ❗ To avoid short circuiting between the charge lead, always connect the charge cable to the charger first, then connect the battery. Reverse the sequence when disconnecting.
- ❗ Never attempt to charge or discharge the following types of batteries:
 - A battery fitted with an integral charge circuit or a protection circuit
 - A battery pack which consists of different types of cells (including different manufacturers)
 - A battery that is already fully charged or just slightly discharged
 - Non-rechargeable batteries (pose an explosion hazard)
 - A faulty or damaged battery

- Batteries installed in a device or which are electrically linked to other components
- Batteries that are not expressly stated by the manufacturer to be suitable for the currents the charger delivers during the charge process

! Please bear in mind the following points before commencing charging:

- Did you select the appropriate program suitable for the type of battery you are charging?
- Did you set up adequate current for charging or discharging?
- Have you checked the battery voltage? Lithium battery packs can be wired in parallel and in series, i.e. a 2-cell pack can be 3.7V (in parallel) or 7.4V (in series).
- Have you checked that all connections are firm and secure? Make sure there are no intermittent contacts at any point in the circuit.

Standard Battery Parameters

	LiPo	LiIon	LiFe	NiCd	MiMH	Pb
Nominal Voltage	3.7V/cell	3.6V/cell	3.3V/cell	1.2V/cell	1.2V/cell	2.0V/cell
Max Charge Voltage	4.2V/cell	4.1V/cell	3.6V/cell	1.5V/cell	1.5V/cell	2.46V/cell
Storage Voltage	3.8V/cell	3.7V/cell	3.3V/cell	n/a	n/a	n/a
Allowable Fast Charge	≤1C	≤1C	≤4C	1C-2C	1C-2C	≤0.4C
Min. Discharge Voltage	3.0-3.3V/cell	2.9-3.2V/cell	2.6-2.9V/cell	0.1-1.1V/cell	0.1-1.1V/cell	1.8V/cell

CAUTION! When adjusting your X1 MF charging parameters, be sure you select the proper battery type and cell voltage for the type of cell you are charging. Charging batteries with the wrong settings may cause the cells to burst, catch fire, or explode.

! Charging

Before charging your batteries, it is critical that you determine the maximum allowable charge rate for your batteries. The X1 MF has the capability to charge at high rates that may not be suitable or safe for your particular batteries. For example, Lithium cells are typically safe to charge at 1C, or the total mAh/1000. A 1200mAh battery would have a 1C charge rate of 1.2 Amps. A 4200mAh battery would have a 1C charge rate of 4.2 Amps. Some manufacturers are offering Lithium cells that can be charged at greater than 1C but this should ALWAYS be verified before charging a lithium battery at rates higher than 1C. Voltage is just as critical as the charging amperage rate and this is determined by the number of cells in series, or "S". For example, a 3S LiPo is rated at 11.1 Volts ("S" multiplied by a single LiPo cell voltage of 3.7 VDC. 3 cells x 3.7 volts each equals 11.1 volts).

Connect the battery's main leads to the charger output: red is positive and black is negative. Keep in mind that the gauge or thickness of your charging leads from the X1 MF to your battery must be of an acceptable current rating to handle the applied charge current. For maximum safety and charging effectiveness, always match or exceed the main battery lead rating when assembling or selecting your charging leads. Simply put, if you charge a battery at a high current rate (amperage rate) with a charging lead not rated for the chosen amperage, the wire could get hot, catch fire, short out, and potentially destroy your battery and the charger. When in doubt, a higher gauge wire (lower AWG number) is always safest! It's common practice to see charging leads constructed of 14AWG, 16AWG or 18AWG wire.

Always refer to recommendations from your battery manufacturer for your specific battery type and size before initiating a charge or discharge process.

Do not attempt to disassemble or modify Lithium or Lead-Acid battery packs.

Note: Lithium battery packs can be purchased with some cells in series and others in parallel. Parallel wired cells (indicated on the pack by the letter “P”) maintain a single cell’s voltage but increase capacity with each cell added. For example, 3 LiPo cells rated for 800mAh capacity each, wired in parallel would produce a pack rated for 3.7 Volts and 2400mAh.

⚠ Discharging

The X1 MF discharging functions are for two specific purposes:

- Refreshing the capacity of a Nickel-based battery that has lost capacity over time (NiMH or NiCd).
- Reducing the voltage of a Lithium battery for safe storage or *cycling for initial use.

Warning! Lithium packs should only be discharged to their minimum safe voltage and no lower. Deep discharging a Lithium cell will do permanent damage. Refer to the Standard Battery Parameters table on page 7 of this manual for Minimum Discharge Voltages.

*LiPo charge/discharge cycling – Lithium batteries are known to reach full capacity after a break-in period of about 10 charge/discharge cycles. You do not have to do this with the X1 MF; normal use and recharging will achieve the same results. If you wish to perform a Lithium break-in on the bench with the X1 MF, discharging to minimum acceptable voltages and performing a balance charge at 1C maximum rate is recommended. If you choose to break in your Lithium batteries under normal use, charging at only 1C for the first ten cycles will help ensure full performance and service life from your Lithium cells.

LITHIUM BATTERY CONNECTION DIAGRAM

The X1 MF can be powered either from a wall outlet supplying 100-240VAC (50-60Hz) or from a 12VDC automotive battery. Make sure a 12VDC source battery is fully charged before using the X1 MF. A fully charged 12VDC automotive battery should read about 13.8V.

NOTE: DC INPUT: The maximum charge circuit power is 80W.
AC INPUT: The maximum charge circuit power is 50W.



Using terminal clips attached to a car battery

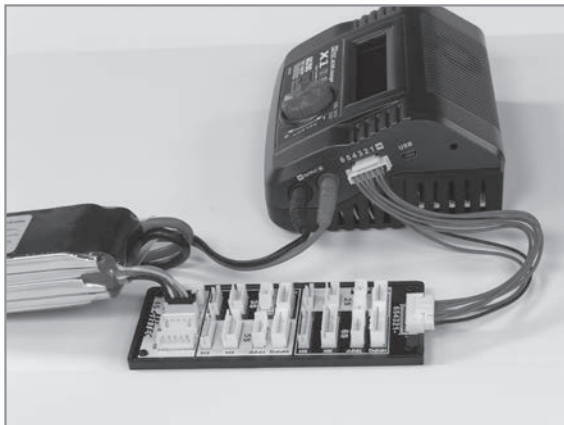
CONNECTING THE BATTERY

Important! Prior to connecting your battery to the X1 MF, verify that you have chosen the correct battery type, pack voltage, and safe charging amperage rate. If the settings are incorrect, the battery may be damaged, catch fire, or explode during the charging process. NEVER CHARGE A BATTERY UNNATTENDED!!! Always connect the banana plugs to the charger first and the battery second. Disconnect the battery connection first after charge is complete, then remove the banana plugs.


Balancing Board:

The balancing port lead polarity is critical! Verify that the black wire (negative) coming from the balancing board is connected to the negative port (-) on the charger. Failure to do so will damage the charger!!

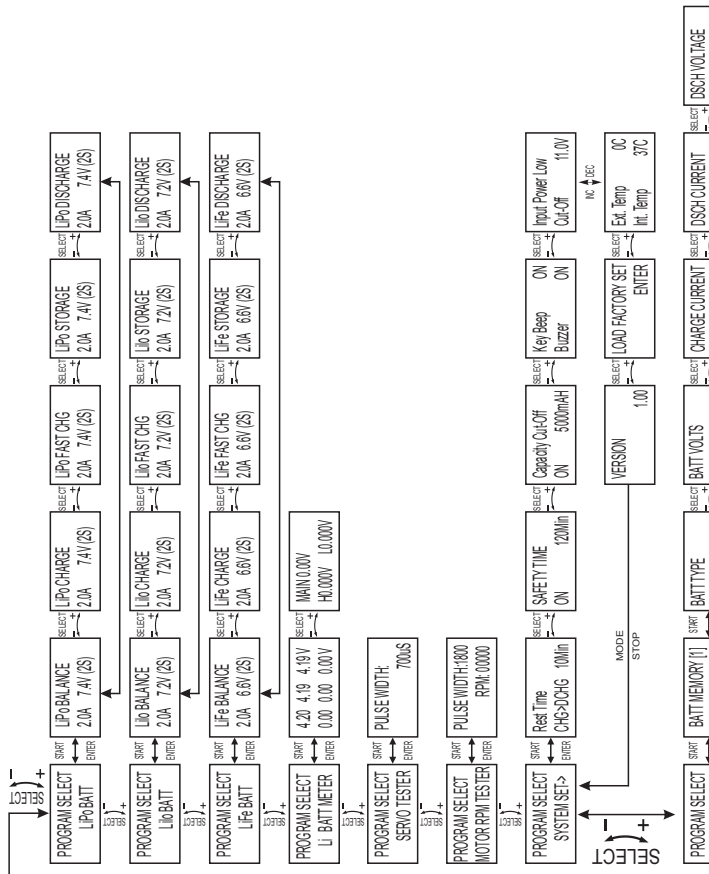
This image shows the correct way to connect your battery and the balancing board to the X1 MF before charging in the balance charge mode.



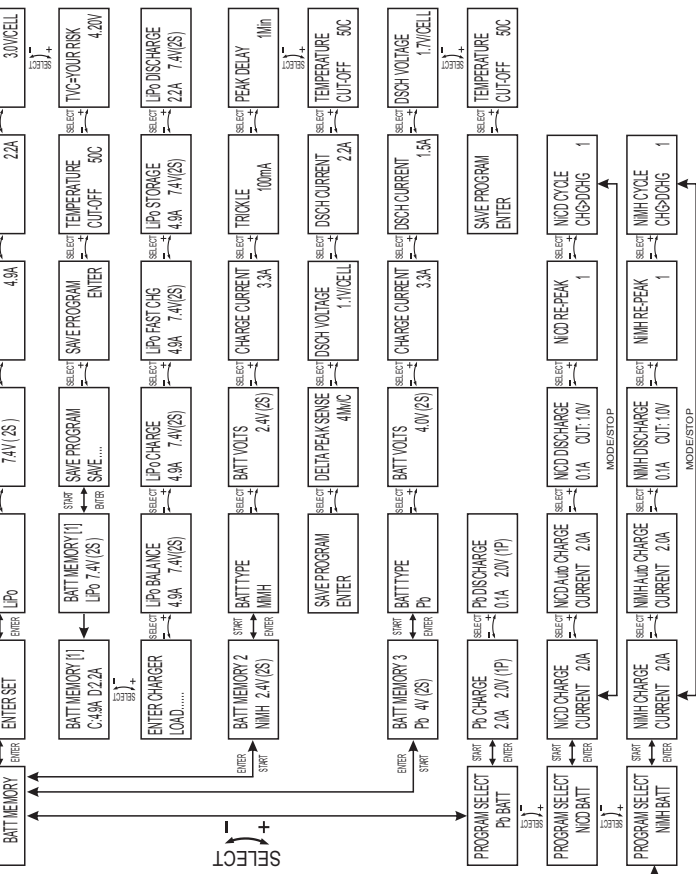
WARNING

 Failure to connect the battery and balancing board as shown in this image will result in damage to the charger!

PROGRAM FLOW CHART

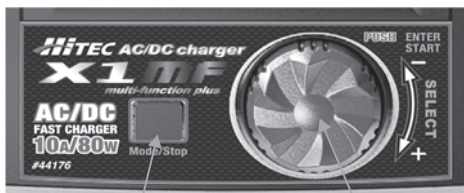


PROGRAM FLOW CHART



OPERATION

Control and adjustment of the X1 MF is accomplished using the red rotary push button dial and the black Mode/Stop button.



Mode/Stop Button

Enter/Start Rotary Dial

Enter/Start Rotary Dial

This dial has many functions. Rotating the dial in both directions will scroll through menus and adjust parameters quickly and easily, and pressing down on the dial to commit parameters, begin processes, or store parameters on-screen.

When you power on the X1 MF, its default display will show the LiPo Balance Charge process. Simply rotating the dial will switch between Balance Mode, Normal Charge Mode, Fast Charge Mode, Storage Charge Mode, or Discharge Mode. Pressing the rotary dial once in any of these modes will take you through the parameter setup for your battery and the process you have selected. Pressing and holding the rotary dial for three seconds will begin the process. If you wish to choose another function or battery type, pressing the Mode/Stop button once will take you to the root menu where you can choose different functions, store process memory, or adjust core parameters for each function.

Mode/Stop Button

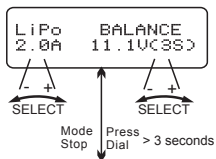
The Mode/Stop button functions like the ESC key on a keyboard, backing you out of a menu level or stopping any currently running process. The Mode/Stop button is also how you access the root function menu in programming. Pressing Mode/Stop immediately after power-up will take you into the root selection menu.

LITHIUM BATTERY (LiPo/LiFe/LiIon) PROGRAM

The X1 MF Lithium programs are only suitable for charging and discharging Lithium batteries with a nominal voltage of 3.7V, 3.6V and 3.3V per cell. Lithium charge termination methodology is referred to as CC/CV (Constant Current, Constant Voltage). Lithium charging begins by delivering a constant current to the battery as specified in the setup parameters. Once the charger detects increased resistance and a reduced voltage increase, it begins to reduce the current and closely monitors the pack's voltage. When voltage levels have reached the maximum standard and hold steady, the charge process terminates. The maximum voltage for each cell chemistry is the key to the charging process, they are 4.2V for LiPo, 3.6V for LiFe, and 4.1V for LiIon. The charging current and the nominal cell voltage is most critical when charging Lithium cells as this is what drives the intelligent charging process. **NEVER use NiMH, NiCd, or Pb charge parameters on a Lithium cell. These charging methods cannot properly determine cutoff and will over charge and explode a Lithium battery!!**

CHARGING LITHIUM BATTERIES IN BALANCE MODE

For Lithium packs containing more than one cell, balance charging is the preferred method. Balance charging actually monitors and adjusts each individual cell's voltage so that each cell is at maximum charge when the process ends. Balanced packs deliver more consistent current and voltage as the pack is drained. Balance charging also provides insurance against over-charging since the nominal pack voltage is read from each cell's individual voltage as opposed to the main leads. If one or two cells are lower than the others, non-balanced charging may drive the pack to a calculated total voltage for cutoff while over-charging the high cells and undercharging the low cells.

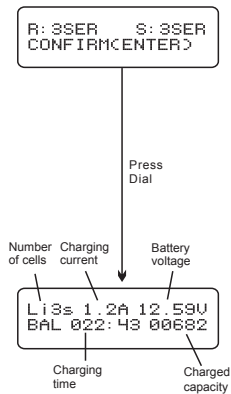


Top Line (left to right): Selected Battery Type and Charge Mode

Bottom Line (left to right): Charging Rate and Pack Nominal Voltage/Cell Count

Adjust the parameters, then press and hold the dial for 3 seconds to start the process.

LITHIUM BATTERY (LiPo/LiFe/LiIon) PROGRAM

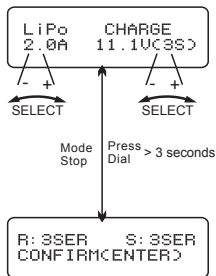


This screen displays the number of cells detected by the charger (R), and the number of cells you selected in the previous screen (S). If these numbers mismatch, go back to the previous screen and verify your settings. If your settings are correct, there may be a problem with one or more cells in your pack. Verify the pack total voltage (from the main leads) is within normal expected range. If it is, you may have a problem with one or more of the balancing leads coming from the pack.

This screen displays the real-time status of the charge process. Pressing the Mode/Stop button once will end the charge process and return you to the setup screen.

CHARGING OF LITHIUM BATTERIES

“Charge” Mode is for charging Lithium batteries without a balancing connector present. It is highly recommended to always charge in Balance Mode if possible. This will ensure the best performance and longest life of your Lithium batteries.



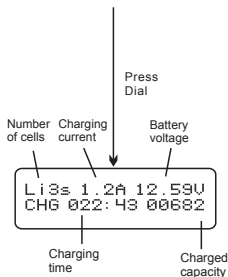
Top Line (left to right): Selected Battery Type and Charge Mode

Bottom Line (left to right): Charging Rate and Pack Nominal Voltage/Cell Count

Adjust the parameters, then press and hold the dial for 3 seconds to start the process.

This screen displays the number of cells detected by the charger (R), and the number of cells you selected in the previous screen (S). If these numbers mismatch, go back to

LITHIUM BATTERY (LiPo/LiFe/LiIon) PROGRAM

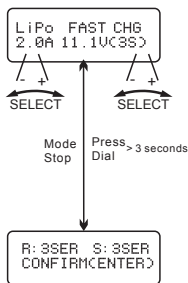


previous screen and verify your settings. If your settings are correct, there may be a problem with one or more cells in your pack. Verify the pack total voltage (from the main leads) is within normal expected range.

This screen displays the real-time status of the charge process. Pressing the Mode/Stop button once will end the charge process and return you to the setup screen.

"FAST" CHARGING OF LITHIUM BATTERIES

Fast charging of Lithium batteries is accomplished by the charger ending the charge process as the pack voltage nears the maximum levels, modifying the "CV" portion of the charge process. Normal charging reduces current to 1/10th during CV, whereas "Fast" only reduces current to 1/5th the starting value, thus ending earlier. This mode is beneficial when a quick turn around is needed between race heats or getting back in the air is more important than having a fully charged battery.



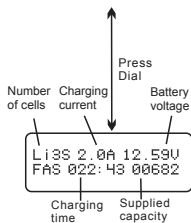
Top Line (left to right): Selected Battery Type and Charge Mode

Bottom Line (left to right): Charging Rate and Pack Nominal Voltage/Cell Count

Adjust the parameters, then press and hold the dial for 3 seconds to start the process.

This screen displays the number of cells detected by the charger (R), and the number of cells you selected in the previous screen (S). If these numbers mismatch, go back to the previous screen and verify your settings. If your

LITHIUM BATTERY (LiPo/LiFe/Lilon) PROGRAM

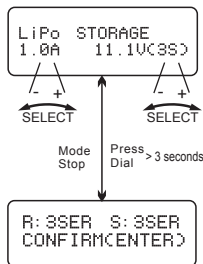


settings are correct, there may be a problem with one or more cells in your pack. Verify the pack total voltage (from the main leads) is within normal expected range.

This screen displays the real-time status of the charge process. Pressing the Mode/Stop button once will end the charge process and return you to the setup screen.

"STORAGE" CONTROL OF LITHIUM BATTERIES

Long term storage of Lithium batteries at certain voltage levels can maintain pack health and insure long life. Storing Lithium cells at full charge can cause cell degradation and "puffing." Too low, and the cell capacity and operational life can be compromised. The X1 MF will automatically begin charging or discharging to storage levels, based on the battery voltage when connected. Storage levels are different for each cell chemistry: 3.75V for Lilon, 3.85V for LiPo and 3.3V for LiFe per cell.



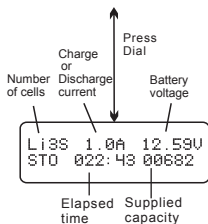
Top Line (left to right): Selected Battery Type and Charge Mode

Bottom Line (left to right): Charging Rate and Pack Nominal Voltage/Cell Count

Adjust the parameters, then press and hold the dial for 3 seconds to start the process.

This screen displays the number of cells detected by the charger (R), and the number of cells you selected in the previous screen (S). If these numbers mismatch, go back to the previous screen and verify your settings. If your settings are correct, there may be a problem

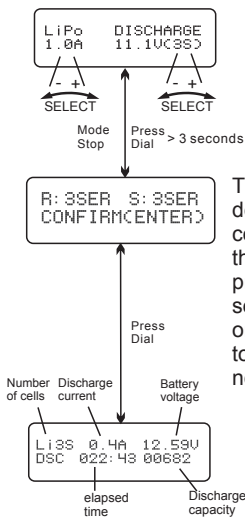
LITHIUM BATTERY (LiPo/LiFe/LiIon) PROGRAM



with one or more cells in your pack. Verify the pack total voltage (from the main leads) is within normal expected range.

This screen displays the real-time status of the storage process. Pressing the Mode/Stop button once will end the storage process and return you to the setup screen.

DISCHARGING LITHIUM BATTERIES



The value of discharge current on the left can not exceed 1C, and the value on the right can not be under the voltage recommended by the manufacturer to avoid over discharging. Press and hold the dial for 3 seconds to start discharging.

This screen displays the number of cells detected by the charger (R), and the number of cells you selected in the previous screen (S). If these numbers mismatch, go back to the previous screen and verify your settings. If your settings are correct, there may be a problem with one or more cells in your pack. Verify the pack total voltage (from the main leads) is within normal expected range.

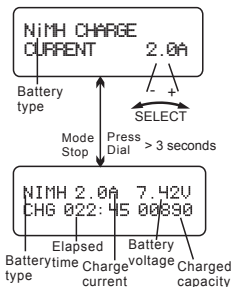
This screen displays the real-time status of the discharge process. Pressing the Mode/Stop button once will end the discharge process and return you to the setup screen.

NiMH/NiCd BATTERY PROGRAM

These programs are for charging or discharging Nickel-Metal Hydride (NiMH) or Nickel-Cadmium (NiCd) batteries.

CHARGING OF NiMH/NiCd BATTERIES

The standard charge mode for NiMH and NiCd batteries will use the charge current set by the user.

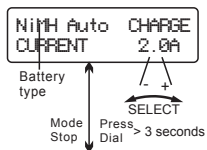


Pressing the dial once will allow you to set the charging amperage for the charge process. Refer to manufacturer specifications for maximum charge rates for your Nickel-based battery packs.

This screen displays the charge status in real-time. Pressing the Mode/Stop button once will end the process and return you to the setup screen.

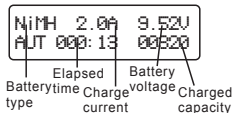
CHARGING NiMH/NiCd BATTERIES IN THE AUTO CHARGE MODE

In this mode, the charger automatically detects the connected NiMH or NiCd battery and determines the proper full charge and cutoff thresholds. Setting the upper charge current limit for safe levels based on your battery specifications will ensure safe charging of your specific battery. If you are unsure of the maximum allowable charge rates, set the charger to a maximum of 1C (battery mAh/1000, i.e., 2500mAh = 2.5A)



Pressing the dial once will allow you to set the charging amperage for the charge process. Refer to manufacturer specifications for maximum charge rates for your Nickel-based battery packs.

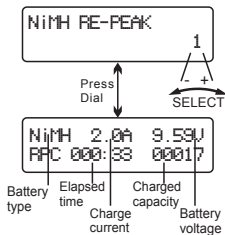
NiMH/NiCd BATTERY PROGRAM



This screen displays the real-time status of the charging process. Pressing the Mode/Stop button once will end the charging process and return you to the setup screen.

CHARGING NiMH/NiCd BATTERIES IN RE-PEAK CHARGE MODE

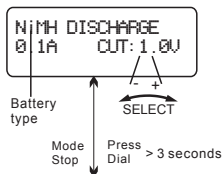
Applicable to NiMH and NiCd batteries only, in re-peak mode the charger can peak charge the battery once, twice, or three times in a row automatically. This process is good for confirming the battery is fully charged and for verifying how well the battery can accept a fast charge. A five-minute cool-down delay occurs after each re-peak charge. Press the dial for 3 seconds to begin the re-peak process.



Re-peak cycle number 1 is displayed on the screen. Pressing the dial once will allow you to scroll through and set up to 3 total cycles. Press and hold the dial to begin the re-peak process.

This screen displays the real-time status of the re-peak process. Pressing the Mode/Stop button once will end the re-peak process and return you to the setup screen.

DISCHARGING OF NiMH/NiCd BATTERIES

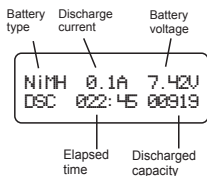


Set the discharge current on the left and the final pack voltage on the right.

Discharge current range: 0.1 to 5.0A
Final voltage range: 0.1 to 25.2V

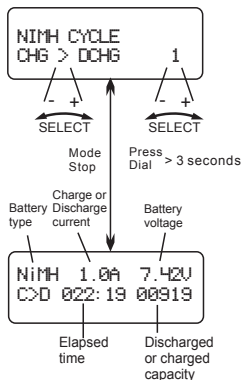
To start the process, press the dial for three seconds.

NiMH/NiCD BATTERY PROGRAM



This screen displays the real-time status of the discharge process. Pressing the Mode/Stop button once will end the discharge process and return you to the setup screen.

CHARGE/DISCHARGE & DISCHARGE/CHARGE CYCLE OF NiMH/NiCD BATTERIES



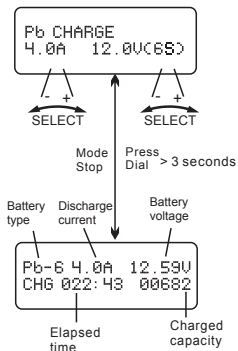
You can adjust the cycle flow (Discharge>Charge or Charge>Discharge) from this screen as well as the number of cycles requested. Pressing the dial for 3 seconds will start the process.

From this screen you can press the dial once and scroll to adjust the current, or press the Mode/Stop button once to end the process and return to the setup screen.

PB (LEAD-ACID) BATTERY PROGRAM

Pb or Small Lead-Acid (SLA) batteries typically found in ATVs, lawn mowers and motorcycles require their own specific charging procedures. Pb batteries, as a rule, are unable to charge at higher rates like Nickel or Lithium-based batteries. Pb batteries should always be stored fully charged to avoid sulfation and cell degradation. Always consult the manufacturer's recommendation for proper charging and charge rates of your Pb battery. **Charge in a well ventilated area.**

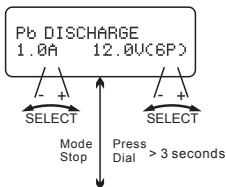
CHARGING OF PB BATTERIES



Adjust the charge current on the left by pressing the dial and rotating. Press again to set the value. Repeat the procedure for the cell voltage on the right. The charge current range is 0.1A to 10.0A. Typical Pb cell voltage is 2.0 volts per cell. "S" indicates series configuration, so a 12.0V Pb battery would be 6S. A 6.0V Pb battery would be 3S.

This screen displays the real-time status of the charging process. Pressing the Mode/Stop button once will end the charging process and return you to the setup screen.

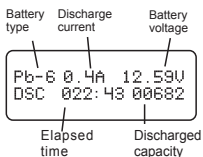
DISCHARGING OF PB BATTERIES



Set the discharge current on the left and the cutoff voltage on the right. The discharge current ranges from 0.1A to 5.0A.

Press the dial for 3 seconds to start the discharge process.

PB (LEAD-ACID) BATTERY PROGRAM



This screen displays the real-time status of the discharge process. Pressing the Mode/Stop button once will end the discharge process and return you to the setup screen.

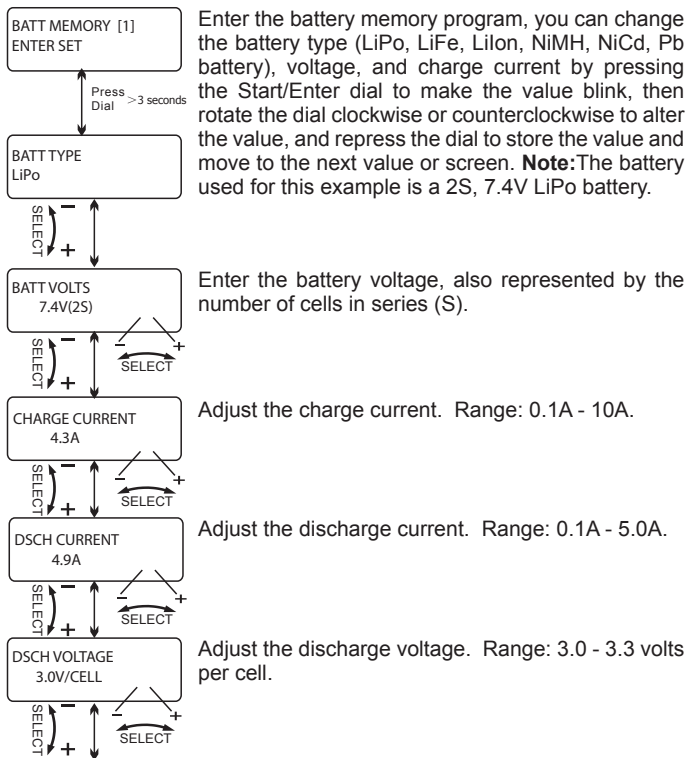
USING THE HITEC CHARGE MASTER SOFTWARE

The free “Hitec Charge Master” software gives you unparalleled ability to operate the charger through the computer. You can monitor pack voltage, cell voltage and other data during charging and discharging. Hitec Charge Master also allows you to graph process data in real-time and you can control charging and update the X1 MF’s firmware all from the software interface.

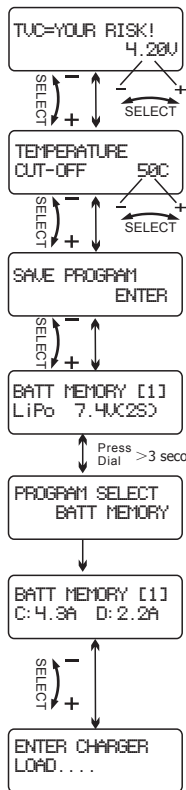
In order to connect the X1 MF to the computer and use the software, you will need a USB-A to USB Mini-B cable that is not included in this package.

You can download your copy of the Hitec Charge Master software from <http://www.hitecrd.com>.

The charger can store up to 10 different charge/discharge profiles for your convenience, and the stored profiles can be recalled quickly without having to go through the setup process.



BATTERY MEMORY SET



Set the process termination voltage. Range: 4.18V - 4.30V. **CAUTION:** be sure to set/verify the correct end voltage of the type of cell you are charging. Over charging batteries can result in fire or explosion!

If you are using the optional external Temperature Sensor, set the temperature cutoff. If you are not using the Temperature Sensor, leave this setting as-is.

Save the program entry by pressing and holding the dial for 3 seconds.

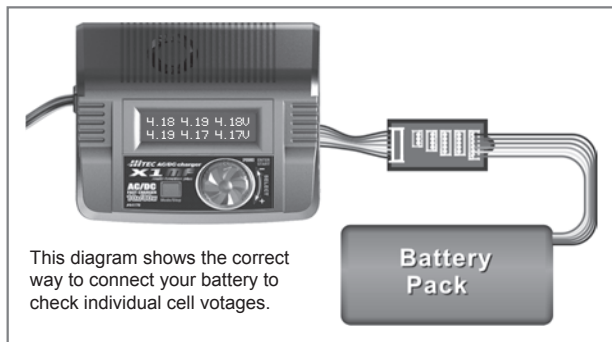
Once saved, the display will return to the newly saved programs entry in the saved program list.

To recall a saved program, press Mode/Stop, scroll to the Program Select Batt Memory screen and press the dial.

Rotate the dial through the saved memory slots until you find the memory you are trying to activate. Once located, press and hold the dial for 3 seconds.

This screen indicates that the memory you have selected is being loaded and activated.

You can check your battery's total voltage and each cell's individual voltage, as well as the highest and lowest cell voltages, when using the battery Balancing Board. Connect your Lithium battery as shown in the image below:



PROGRAM SELECT
Li BATT METER

Press
Dial

4.13 4.12 4.13V
0.00 0.00 0.00V

SELECT

MAIN 12.38V
HH.130V LL.110V

Press the Mode/Stop button to return to the root menu, scroll to select the "Li Batt Meter" program and press the dial for 3 seconds to enter the "Li Batt Meter" program.

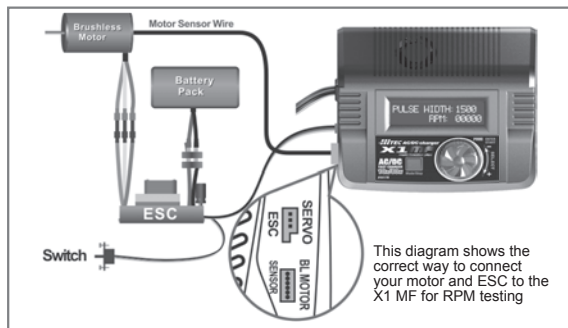
The display will show each Lithium cell's voltage. 3S LiPo shown as example.

Scroll to see the current total pack voltage (Main) as well as the highest and lowest voltage read for individual cells.

MOTOR RPM TESTER

The X1 MF can test brushless motor RPM if you have a motor equipped with a sensor port. To check motor RPM, please connect as follows:

1. Connect the motor to the ESC, turn off ESC and connect main battery.
2. Connect power to the X1 MF.
3. Insert the ESC radio lead into the SERVO/ESC port on the X1 MF.
4. Connect the sensor wire between the X1 MF and the motor.
5. Enter the Motor RPM Tester Program and set the initial pulse width to around 1480. You may have to adjust the pulse width up or down to find neutral (stick center).
6. Turn on the ESC and adjust the dial to increase or decrease motor RPM.



PROGRAM SELECT
MOTOR RPM TESTER



PULSE WIDTH: 1480
RPM: 00000

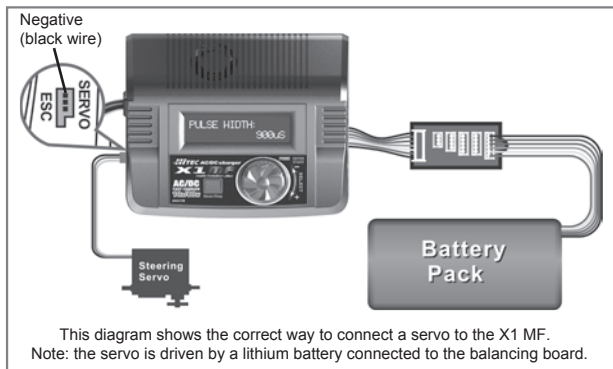


Scroll to the Motor RPM Tester program and press the dial once.

Set the initial pulse width to around 1480, this is the common value for throttle channel center/neutral. If you find the ESC is not initializing properly, lower or raise the value slightly and re-initialize the ESC.

The X1 MF can test most digital and analog servos. To test for basic servo functionality, please connect as follows:

1. Connect a lithium battery to the balancing board.
2. Connect your servo to the SERVO/ESC port on the X1 MF. Pay close attention to the polarity: negative is farthest from the notch/key tab.
3. Turn the dial left and right to move the servo.



PROGRAM SELECT
SERVO TESTER

Press the dial once to enter the Servo Tester Program

SELECT
-
+

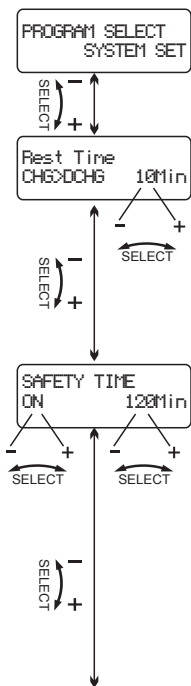
PULSE WIDTH
900µS

Adjust the pulse width by turning the dial left or right to test servo functionality.

- +
SELECT

SYSTEM SETUP

Upon first initialization, the X1 MF default values are loaded. You can adjust these parameters by pressing the Mode/Stop button and scrolling to the System Set screen. Scroll through the various settings by turning the dial left or right. Pressing the dial once will enter the adjustment parameters for the selected setup variable. Once you make adjustments, press the dial again to return to the System Set menu. When you have completed changes, pressing Mode/Stop again will exit programming.



Press the dial once to enter the System Setup menu.

Rest time refers to the wait period between cyclic discharge/charge processes. Nickel battery chemistry benefits by having a “rest” period between cycles to allow the voltage to normalize between cells and let heat generated by the charge process dissipate. This increases charging efficiency and can reduce the probability of out-gassing of the cells due to high heat. Rest Time value range: 1 to 60 minutes.

The X1 MF has an integrated safety timer for all charge processes. You can set the maximum charge time as a backup in the event the X1 MF is unable to detect the proper charge cutoff conditions. This can happen when charging faulty cells, exhausted packs, or packs exhibiting abnormal resistance or voltage fluctuations.

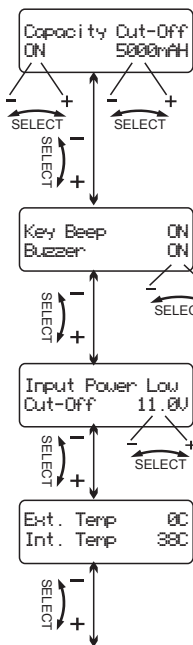
Safety Timer Calculation

To calculate the outside allowable charge time for NiMH or NiCd batteries, divide the capacity by the current, then divide the result by 11.9. This time calculation will allow the charger to run

with enough time to charge 140% of the battery's rated capacity. Delta Peak termination should, under normal circumstances, end the charge process within this allotted time.

For example:

Capacity	Current	Safety Time
2000mAh	2.0A	$(2000/2.0=1000)/11.9=84$ minutes
3300mAh	3.0A	$(3300/3.0=1100)/11.9=92$ minutes
1000mAh	1.2A	$(1000/1.2=833)/11.9=70$ minutes



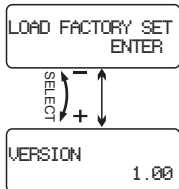
Similar to the Safety Timer, Capacity Cut-Off allows you to limit the maximum charge capacity of the charging process. Limiting a charge process on a 1200mAh battery to 1300mAh, for example, can protect against extreme overcharging. Consult your battery manufacturer's recommendation for limits.

Key Beep refers to the audible sound emitted every time you press a button on the X1 MF. Buzzer refers to the sounds emitted when a process is complete, a cycle changes, or there is an error state detected. You can silence these audible alerts in this setting.

The X1 MF can operate on DC power between 11-18V. High current charging processes will "sag" the incoming voltage so a low voltage threshold can be set to insure uninterrupted charging and maintain charging rates.

Internal and external temperatures can be displayed. External temperature status requires the use of the optional Temperature Sensor Cable, PN #44159.

VARIOUS INFORMATION DURING PROCESSES



Press the dial for 5 seconds to restore the X1 MF to the firmware defaults.

The last value on the system setup menu displays the current firmware version of the X1 MF. You can use a USB cable to update the X1 MF to the latest firmware version. Visit www.hitecrd.com for more information.

VARIOUS INFORMATION DURING PROCESSES

While processes are running, you can display additional information by scrolling the dial left or right, including individual cell voltages (Lithium processes with balance board connected), total pack voltage, input voltage, etc. Additional information displayed depends on the current running process.

End Voltage
12.6V(3S)

End process voltage limit is displayed. This value can be set by the user in system setup.

IN Power Voltage
12.72V

Displays the supplied voltage from either the internal power supply or external DC source.

Ext. Temp 0C
Int. Temp 27C

Displays the internal temperature and external temperature (requires Temp. Sensor PN:44159).

Safety Time
ON 200min

Displays the maximum process safety timer. This value can be set by the user.

Capacity Cut-Off
ON 4800mAh

Displays the maximum capacity cut-off. This value can be set by the user in system setup.

4.19 4.18 4.18V
0.00 0.00 0.00V

Displays individual cell voltages if charging a lithium battery connected to the balancing board.

WARNING AND ERROR MESSAGES

The X1 MF has advanced error sensing logic to help protect the charger and your batteries in the event of a problem. The error messages below will display along with an audible alert.

REVERSE POLARITY

Indicates that the main battery leads are reversed. *Reverse the leads to the charger from the battery.*

CONNECTION BREAK

Indicates that the charger has lost connection to the battery. *Verify the main leads are still connected.*

CONNECT ERROR
CHECK MAIN PORT

The charger has not sensed a connected battery. *Verify that the battery is connected to the charger.*

BALANCE CONNECT
ERROR

There is a problem with the balance board connection. *Connect balance board for Balance Charging.*

DC IN TOO LOW

Input voltage is too low. *Verify the input voltage is between 11-18V DC. May be set too low by user.*

DC IN TOO HIGH

Input voltage is too high. *Verify the input voltage is between 11-18V DC.*

CELL ERROR
LOW VOLTAGE

Balanced lithium charging has detected one or more cells below the minimum voltage levels.

CELL ERROR
HIGH VOLTAGE

Balanced lithium charging has detected one or more cells above the maximum voltage levels. *Balance pack.*

CELL ERROR
VOLTAGE INVALID

Charger has detected that the connected cells are not within selected parameters. *Verify battery type setup.*

CELL NUMBER
INCORRECT

The cells count you have selected does not coincide with the detected cell count. *Verify setup parameters.*

INT. TEMP. TOO HIGH

Internal temperature is too high. *Move charger to a cooler, ventilated location between 0-30°C (32-86°F)*

EXT. TEMP. TOO HIGH

External Temperature Sensor (optional) has reached the upper limit set by the user.

OVER CHARGE
CAPACITY LIMIT

Total charged amount (capacity) has reached upper limit set by the user. *Verify charge capacity limits.*

OVER TIME LIMIT

Total allowable charge time has reached set limits. *If premature, verify charge time limit in setup.*

BATTERY WAS FULL

The charger read a total pack voltage at or higher than the total amount allowed for the selected battery.

SPECIFICATIONS

SPECIFICATIONS

AC Input	100-240V 60Hz
DC Input	11-18V
Charge circuit power	AC Input 50W DC Input 80W
Charge current range	0.1-10.0A
Discharge current power	8W
Discharge current range	0.1-5.0A
Current drain for balancing port	200mA/cell
NiCd/NiMH battery cell count	1-15 Cells
LiPo/LiFe/Lilon cell count	1-6 Cells
Pb battery voltage	2-20V
Net weight	525g (18.5oz)
Dimension	135 x 112 x 60.9mm(5.34 x 4.4 x 2.4in.)

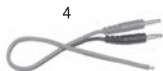
Product specifications and figures are subject to change without notice.

THIS PACKAGE CONTAINS

1. X1 MF Charger
2. Hitec Universal Balance Board
3. Power Cord
4. 18AWG Charging Cable



1



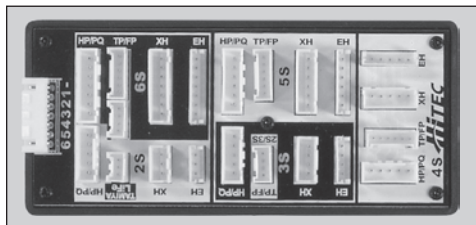
4



3



2



Hitec Universal Balance Board
PN: 44178



Hitec External
Temperature Sensor
PN: 44159

LIABILITY EXCLUSION

This charger is designed and approved exclusively for use with the types of batteries stated in this Instruction Manual. Hitec RCD, USA accepts no liability of any kind if the charger is used for any purpose other than that stated. We are unable to ensure that you follow the instructions supplied with the charger, and we have no control over the methods you employ for using, operating and maintaining the device. For this reason we are obliged to deny all liability for loss, damage or costs which are incurred due to any misuse or operation of our products. Unless otherwise prescribed by law, our obligation to pay compensation, regardless of the legal argument employed, is limited to the invoice value of Hitec RCD, USA products which were immediately and directly involved in the event in which the damage occurred.

CONFORMITY DECLARATION

The Hitec RCD USA X1 MF charger satisfies all relevant and mandatory FCC and EC regulatory directives including the following:

Test Standards	Title	Result
EN 61000-6-3: 2007	Electromagnetic compatibility (EMC) -- Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments	Conform
EN 55014- 1: 2006	Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus -- Part 1: Emission	Conform
EN 61000-6- 1: 2007	Electromagnetic compatibility (EMC) Part 6-1: Generic standards Immunity for residential, commercial and light-industrial environments	Conform
EN 55014-2: 1997+ A1: 2001+A2:2008	Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus - Immunity - Product family standard	Conform



This symbol indicates that when this type of electronic device reaches the end of its service life, it cannot be disposed of with normal household waste and must be recycled. To find a recycling center near you, refer to the internet or your local phone directory for electronic waste recycling centers.

STATE OF CALIFORNIA PROPOSITION 65 WARNING:

This product contains chemicals known to the State of California to cause cancer. Use caution when handling this product and avoid exposure to any electronic components or internal assemblies.

Distributed By:



Hitec RCD USA, Inc.
12115 Paine St.
Poway CA 92064
(858) 748-6948, 8:00AM-4:30PM, PST



www.hitecrcd.com

ONE YEAR LIMITED WARRANTY

For a period of one year from the date of purchase HITEC RCD USA, INC. shall REPAIR OR REPLACE, at our option, defective equipment covered by this warranty, otherwise the purchaser and/or consumer is responsible for any charges for the repair or replacement of the charger. This warranty does not cover cosmetic damages and damages due to acts of God, accident, misuse, abuse, negligence, improper installation, or damages caused by alterations by unauthorized persons or entities. This warranty only applies to the original purchaser of this product and for products purchased and used in the United States of America, Canada and Mexico. Plastic cases are not covered by this warranty.

THIS WARRANTY IS IN LIEU OF ANY AND ALL OTHER WARRANTIES, WHETHER FOR MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE AND WHETHER EXPRESS OR IMPLIED. REPAIR OR REPLACEMENT AS PROVIDED UNDER THIS WARRANTY IS THE EXCLUSIVE REMEDY. HITEC RCD, INC. SHALL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES FOR BREACH OF ANY EXPRESS OR IMPLIED WARRANTY RELATING TO THIS PRODUCT. EXCEPT TO THE EXTENT PROHIBITED BY APPLICABLE LAW. ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ON THIS PRODUCT IS LIMITED IN DURATION TO THE DURATION OF THIS WARRANTY.

REPAIR AND SERVICE

To have your Hitec X1 MF charger serviced:

1. Visit the Hitec website at www.hitecrcd.com and download the service request form (under Support section).
2. Fill out the service request form completely and include a copy of your original receipt showing the purchase date.
3. Package your product in its original packaging or use a suspension-type packaging (foam peanuts or crumpled newspaper). Hitec RCD shall not be responsible for goods damaged in transit.
4. Ship prepaid (COD or postage-due returns will not be accepted) via a traceable common courier (UPS, insured parcel post, FedEx, etc.) to:

Hitec RCD USA, Inc., Customer Service Center, 12115 Paine St., Poway CA 92064



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